

**TITLE**

**A WIRELESS NETWORK SYSTEM CAPABLE OF TRACKING A  
LOCATION OF A MOBILE STATION AND A METHOD FOR  
TRACKING A LOCATION OF THE MOBILE STATION**

**CLAIM OF PRIORITY**

**[0001]** This application makes reference to, incorporates the same herein, and claims all benefits accruing under 35 U.S.C. §119 from an application for *SUBSCRIBER LOCATION PURSUIT SYSTEM AND METHOD IN PREMISE WIRELESS NETWORK* earlier filed in the Korean Industrial Property Office on 28 August 2002 and there duly assigned Serial No. 2002-51227.

**BACKGROUND OF THE INVENTION**

**Field of the Invention**

**[0002]** The present invention relates to a private wireless network, and more particularly to a system and a method for providing information about a location of a private wireless network subscriber.

**Description of the Related Art**

**[0003]** A private wireless network (also referred to as a Private Mobile Network) generally provides a mobile station (MS) of a private wireless network subscriber with a mobile communication service in a restricted zone such as a specific building, that is, on a premise. As one example of a private wireless system for providing such a mobile communication service, an

1 “InfoMobile” system having been developed by Samsung Electronics Co., Ltd., Korea can be cited.

2 This InfoMobile system provides a variety of wireless calls, data services and Internet Protocol (IP)  
3 terminal services together with Private Automatic Branch Exchange (PABX) functions.

4 **[0004]** In the private wireless network as mentioned above, the mobile station must necessarily  
5 notify the private wireless system of its location, slot mode, power-up/-down state, *etc.*, in order to  
6 be serviced with an incoming call. To realize this, the private wireless network has a location  
7 registration function for managing states and situations of mobile station’s movement in real time  
8 as in a Public Land Mobile Network (PLMN). Even without making a call, the mobile station  
9 occasionally executes location registration, that is, a work for notifying the private wireless system  
10 of its location and state, according to which the notified locations and states of the mobile station  
11 are managed as databased location-registration information in a Home Location Register  
12 (HLR)/Visitor Location Register (VLR) of the private wireless system. The location registration is  
13 commonly subdivided into “power-up registration”, “power-down registration”, “timer-based  
14 registration”, “distance-based registration”, “zone-based registration”, “parameter-change  
15 registration”, “order registration”, “implicit registration”, “traffic channel registration” and so forth.

16 **[0005]** The “power-up registration” is location registration in which a mobile station, not having  
17 been in use, notifies the private wireless system of its current location and state when its power is  
18 turned on. The “power-down registration” is location registration in which power-down of a mobile  
19 station is notified to the private wireless system when its power is turned off. The “timer-based  
20 registration” is location registration which is periodically carried out in order that a mobile station  
21 may be provided with the normal wireless communication service. The “distance-based registration”

1 is location registration which is carried out when a mobile station becomes removed from the last  
2 location-registered spot by a certain distance. The “zone-base registration” is location registration  
3 in which a new location zone is registered with the private wireless system when the location zone  
4 of a mobile station is changed. The “parameter-change registration” is location registration which  
5 is carried out when a user intentionally changes parameters stored in a mobile station, such as phone  
6 numbers or the like. The “order registration” is location registration which is executed by  
7 compulsory order of a base station demanding location registration of a mobile station. The “implicit  
8 registration” is location registration which is implicitly carried out at an outgoing call or an incoming  
9 call response of a mobile station. The “traffic channel registration” is location registration which  
10 is implicitly carried out when a location zone of a mobile station is changed through handoff, *etc.*,  
11 during a call. Using the location-registration information according to the above-mentioned location  
12 registration, the private wireless system can judge whether it is possible to make a call to a specific  
13 subscriber or to provide the relevant subscriber with its service or not.

14 **[0006]** On the other hand, a location of a mobile station may be known as the unit of a base station  
15 on the basis of the location-registration information as stated above. Taking notice of this point,  
16 some PLMN service companies are providing location tracking services for allowing to find out a  
17 location and a moving route of a subscriber by indicating, on an electronic map, a location of a base  
18 station with which the latest location of a mobile station has been registered, that is, a base station  
19 which is considered closest to the relevant mobile station.

20 **[0007]** Such a location tracking service, however, is not put in practice in the private wireless  
21 network which uses the location-registration information only for judging whether it is possible to

1 make a call to a specific subscriber or to provide the relevant subscriber with its service or not. Also,  
2 even the location tracking services being put in practice in the PLMN do not provide a subdivided  
3 location of a subscriber within a service zone covered by each base station, but find out a  
4 subscriber's location only as the unit of a base station. In order to enable a subscriber's location to  
5 be more precisely tracked within a service zone covered by a base station, it must be required either  
6 that a mobile station has a GPS (Global Positioning System) receiver so as to notify a base station  
7 of its location information received from a GPS satellite, or that it not only executes location  
8 registration whenever it moves over a certain distance, but also it receives, from a base station with  
9 which the mobile station has registered its location, latitude and longitude information of the relevant  
10 base station, calculates its location on the basis of the received information, and then notifies the  
11 network of the calculated location.

## 12 SUMMARY OF THE INVENTION

13 **[0008]** Accordingly, the present invention has been made to solve the above-mentioned problems  
14 occurring in the background art, and an object of the present invention is to provide a system and a  
15 method for tracking a location of a private wireless network subscriber, which can precisely track  
16 and find out a location of a subscriber even within a service zone of a base station and can realize  
17 this precise tracking in a simple fashion.

18 **[0009]** It is another object to provide a system and a method for precisely tracking a location of  
19 a private wireless network subscriber without using a global positioning system or executing location  
20 registration of a mobile station and receiving latitude and longitude information of a base station.

1     **[0010]** In order to achieve the above and other objects, there is provided a wireless network system  
2     capable of tracking a location of a mobile station including: a visitor location register in which  
3     location information relating to a wireless network location of a mobile station is stored; and a base  
4     station controller storing location information relating to a wireless network location of a mobile  
5     station in said visitor location register when the mobile station registers its location with said  
6     wireless network, and confirming a location of the mobile station by dummy paging and updating  
7     the location information stored in said visitor location register when the mobile station keeps up an  
8     idle state during a certain period.

9     **[0011]** In accordance with another aspect of the present invention, a private wireless network  
10    system capable of tracking a location of a mobile station includes: a private base station controller;  
11    at least one repeater dispersedly installed in sector zones of a private base transceiver station; a  
12    visitor location register in which location information relating to a private wireless network location  
13    of a mobile station is stored, the location information including at least one of a private base  
14    transceiver station number, a sector number and a repeater number; and a private base station  
15    controller storing location information relating to a private wireless network location of a mobile  
16    station in said visitor location register when the mobile station registers its location with said private  
17    wireless network, and confirming a location of the mobile station by dummy paging and updating  
18    the location information stored in said visitor location register when the mobile station keeps up an  
19    idle state during a certain period.

20    **[0012]** In accordance with another aspect of the invention, a private wireless network system  
21    capable of tracking a location of a mobile station includes: a private base station controller; at least

1 one repeater dispersedly installed in sector zones of a private base transceiver station; a visitor  
2 location register in which location information relating to a private wireless network location of a  
3 mobile station is stored, the location information including at least one of a private base transceiver  
4 station number, a sector number and a repeater number; a private base station controller storing  
5 location information relating to a private wireless network location of a mobile station in said visitor  
6 location register when the mobile station registers its location with said private wireless network,  
7 and confirming a location of the mobile station by dummy paging and updating the location  
8 information stored in said visitor location register when the mobile station keeps up an idle state  
9 during a certain period; and a server inquiring about the location information of the mobile station  
10 stored in said visitor location register.

11 **[0013]** In accordance with another aspect of the invention, a method for tracking a location of a  
12 mobile station in a wireless network includes: storing location information relating to a wireless  
13 network location of a mobile station in a visitor location register when the mobile station registers  
14 its location with said wireless network; confirming a location of the mobile station by dummy paging  
15 when the mobile station keeps up an idle state during a certain period; and updating the location  
16 information stored in said visitor location register using the confirmed location information of the  
17 mobile station.

18 **[0014]** Additionally, the location information includes at least one of a base transceiver station  
19 number, a sector number and a repeater number.

20 **[0015]** In accordance with another aspect of the present invention, in a private wireless network  
21 including a visitor location register in which location information of a mobile station is stored, a

1 method for tracking a location of a mobile station includes: storing, by a private base station  
2 controller of said private wireless network, location information relating to a private wireless  
3 network location of a mobile station in said visitor location register when the mobile station registers  
4 its location with said private wireless network; confirming, by said private base station controller,  
5 a location of the mobile station by dummy paging when the mobile station keeps up an idle state  
6 during a certain period; and updating the location information stored in said visitor location register  
7 using the confirmed location information of the mobile station.

8 **[0016]** Preferably, the location information includes at least one of a private base transceiver  
9 station number, a sector number and a repeater number.

10 **[0017]** In accordance with another aspect of the present invention, in a private wireless network  
11 including at least one repeater dispersedly installed in sector zones of a private base transceiver  
12 station and a visitor location register in which location information of a mobile station is stored, a  
13 method for tracking a location of a mobile station includes: storing, by a private base station  
14 controller of said private wireless network, location information of a mobile station in said visitor  
15 location register when the mobile station registers its location with said private wireless network,  
16 the location information including at least one of a private base transceiver station number, a sector  
17 number and a repeater number with respect to the relevant mobile station; confirming, by said private  
18 base station controller, a location of the mobile station by dummy paging when the mobile station  
19 keeps up an idle state during a certain period; and updating the location information stored in said  
20 visitor location register using the confirmed location information of the mobile station.

21 **[0018]** In accordance with another aspect of the present invention, in a private wireless network

1 including a visitor location register and a server representing location information of a mobile  
2 station, a method for tracking a location of a mobile station includes: storing, by a private base  
3 station controller of said private wireless network, location information relating to a private wireless  
4 network location of a mobile station in said visitor location register when the mobile station registers  
5 its location with said private wireless network; confirming, by said private base station controller,  
6 a location of the mobile station by dummy paging when the mobile station keeps up an idle state  
7 during a certain period; updating the location information stored in said visitor location register using  
8 the confirmed location information of the mobile station; and transmitting, by said private base  
9 station controller, the location information of the mobile station to said server when the location  
10 information of the mobile station is stored in said visitor location register.

11 **[0019]** In order to accomplish the above and other objects, there is provided a system for tracking  
12 a location of a subscriber in a private wireless network having a plurality of repeaters dispersedly  
13 installed in sector zones of a private Base Transceiver Station (pBTS), the system including: a  
14 private Base Station Controller (pBSC) connected to the pBTS and a Local Area Network (LAN)  
15 and having a Visitor Location Register (VLR); a location tracking server connected to the LAN; and  
16 at least one client connected to the LAN, wherein the pBSC stores location information in the VLR  
17 when a mobile station executes location registration, the location information including a pBTS  
18 number, a sector number and a repeater number with respect to the relevant mobile station, and  
19 confirms a location and state of a mobile station by dummy paging and updates its location  
20 information stored in the VLR when the relevant mobile station keeps up an idle state during a  
21 certain period, the server inquires out the location information stored in the VLR and transmits it to



1 the client, and the client receives location information from the server and provides a user with the  
2 location and state of the mobile station according to the received location information. When the  
3 client provides a user with the location and state of a mobile station, it displays the location of the  
4 mobile station on a screen in which a topographical map of a service zone of the private wireless  
5 network is represented.

6 **[0020]** In order to achieve the above-mentioned and other objects of the present invention, there  
7 is also provided a method for tracking a location of a subscriber in a private wireless network  
8 including: a step in which a pBSC stores location information when a mobile station executes  
9 location registration, the location information including a pBTS number, a sector number and a  
10 repeater number with respect to the relevant mobile station, and simultaneously transmits the  
11 location information to a server; a step in which the server transmits the location information  
12 received from the pBSC to a client; and a step in which the client receives the location information  
13 from the server and provides a user with a location and state of a mobile station according to the  
14 received location information.

15 **[0021]** The above-mentioned and other objects of the present invention are fulfilled by another  
16 subscriber location tracking method including; a step in which a pBSC stores location information  
17 when a mobile station executes location registration, the location information including a pBTS  
18 number, a sector number and a repeater number with respect to the relevant mobile station; a step  
19 in which a client periodically transmits a message requesting an inquiry about a mobile station  
20 subscriber's state to a server; a step in which the server requests a pBSC to inquire out location  
21 information stored in a VLR in response to the inquiry message; a step in which the pBSC transmits

1 location information stored in the VLR to the server in response to the server's request; a step in  
2 which the server transmits the location information received from the pBSC to the client; and a step  
3 in which the client receives the location information from the server and provides a user a location  
4 and state of a mobile station according to the received location information.

5 **[0022]** In accordance with another aspect of the present invention, the above-mentioned and other  
6 objects are accomplished by yet another subscriber location tracking method including; a step in  
7 which a pBSC stores location information when a mobile station executes location registration, the  
8 location information including a pBTS number, a sector number and a repeater number with respect  
9 to the relevant mobile station; a step in which a user appoints a specific mobile station and requests  
10 a client to inquire about a specific mobile station subscriber's state, and the client transmits a  
11 message inquiring about the specific mobile station subscriber's state to a server in response to the  
12 user's request; a step in which server requests a pBSC to confirm a location and state of the specific  
13 mobile station in response to the client's message; a step in which the pBSC confirms the location  
14 and the state of the specific mobile station by dummy paging, updates location information stored  
15 in a VLR and transmits the updated location information to the server in response to the server's  
16 request; a step in which the server transmits the location information received from the pBSC to the  
17 client; and a step in which the client receives the location information from the server and provides  
18 a user with the location and state of the specific mobile station according to the received location  
19 information.

## 20 BRIEF DESCRIPTION OF THE DRAWINGS

1     **[0023]**     A more complete appreciation of the invention, and many of the attendant advantages  
2     thereof, will be readily apparent as the same becomes better understood by reference to the following  
3     detailed description when considered in conjunction with the accompanying drawings in which like  
4     reference symbols indicate the same or similar components, wherein:

5     **[0024]**     FIG. 1 is a constructional view of a private wireless network including a subscriber  
6     location tracking system in accordance with a preferred embodiment of the present invention;

7     **[0025]**     FIG. 2 is a flowchart of processing by a client shown in Fig. 1 in accordance with a  
8     preferred embodiment of the present invention;

9     **[0026]**     FIG. 3 is a flowchart of processing by a server shown in Fig. 1 in accordance with a  
10    preferred embodiment of the present invention; and

11    **[0027]**     FIG. 4 is a flowchart of processing by a pBSC shown in Fig. 1 in accordance with a  
12    preferred embodiment of the present invention.

### 13                   **DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS**

14    **[0028]**     Hereinafter, preferred embodiments of the present invention will be described in detail  
15    with reference to the accompanying drawings. In the following description of the present invention,  
16    a detailed description of known functions and configurations incorporated herein will be omitted  
17    when it may make the subject matter of the present invention rather unclear.

18    **[0029]**     Fig. 1 shows a constructional view of a private wireless network including a subscriber  
19    location tracking system in accordance with a preferred embodiment of the present invention. This  
20    drawing exemplifies that, as in usual cases, the private wireless network 100 including the subscriber

location tracking system in accordance with a preferred embodiment of the present invention interworks with a Public Land Mobile Network (PLMN) 102 and a Public Switched Telephone Network (PSTN) 104. In such a private wireless network 100, a private Base Station Controller (pBSC) 106 is connected to a Private Automatic Branch Exchange (PABX) 112 and the PLMN 102 as well as a plurality of private Base Transceiver Stations (pBTS) 108. As stated above, the pBSC 106 has a Visitor Location Register (VLR) 120 which manages databased location information according to location registration of a plurality of mobile stations 110. The pBTS 108 is connected to a plurality of repeaters R that are dispersedly installed in its own sector zones. A service zone of the pBTS 108 is commonly divided into three sector zones which are referred to as  $\alpha$ ,  $\beta$  and  $\gamma$ , respectively, and each sector zone is provided with the needed number of repeaters R. For example, one repeater R may be installed at every floor of a building which is serviced with the private wireless network 100. In a case of a building having a large area, one floor may be divided into several sections and one repeater R may be installed at every section. These repeaters R are wirelessly connected to the mobile station 110 to relay communication between the mobile station 110 and the pBTS 108. The PABX 112 and the pBSC 106 are connected to a Local Area Network (LAN) 114. A plurality of clients 118 and a server 116 for providing users of the clients 118 with a subscriber location tracking service in accordance with the present invention are also connected to the LAN 114. As the client 118, a personal computer (PC) is used.

**[0030]** In the private wireless network 100 as stated above, the subscriber location tracking system in accordance with the preferred embodiment of the present invention includes the pBSC 106, the server 116 and the client 118 which are connected to each other via the LAN 114. The

1 pBSC 106 stores a pBTS number, a sector number and a repeater number with respect to a mobile  
2 station 110 as location information in the VLR 120. Herein, the pBTS number is a serial number  
3 of any one among a plurality of pBTS's 108, which is connected to a mobile station executing  
4 location registration. The repeater number is a serial number of any one among a plurality of  
5 repeaters R, which is connected to the mobile station executing location registration. Further, the  
6 sector number is a serial number of any one among a plurality of sector zones, to which the  
7 repeater R connected to the mobile station 110 executing location registration belongs. The fact  
8 that the location information includes the pBTS number, the sector number and the repeater  
9 number forms the foundation for allowing to find out a location of a mobile station 110 as the unit  
10 of a repeater R. That is to say, a location of a mobile station 110 can be more precisely found out  
11 than in the PLMN which tracks the location as the unit of a base station. In addition, when any  
12 of the plurality of mobile stations 110 keeps up an idle state during a certain period, the pBSC 106  
13 confirms a location and state of the relevant mobile station by dummy paging and updates its  
14 location information in the VLR 120. The dummy paging is performed in a similar manner to  
15 ordinary paging. In contrast with the ordinary paging, however, it is performed with regard to any  
16 mobile station which keeps up an idle state during a certain period, by reason of which it is  
17 referred to as "dummy paging". In this way, by performing the dummy paging for a mobile station  
18 keeping up the idle state during a certain period to confirm whether the relevant mobile station is  
19 inside or outside the private wireless network and to confirm, if the mobile station is inside the  
20 private wireless network, what pBTS number, sector number and repeater number correspond to  
21 the location of the mobile station, location information of the mobile station keeping up the idle

1 state can be also managed in real time. Furthermore, since this dummy paging is not paging which  
2 is performed according to a general call processing process, it is set up in such a manner that it is  
3 not counted in paging statistics of the pBSC 106.

4 **[0031]** Meanwhile, the client 118 receives the location information stored in the VLR 120 of  
5 the pBSC 106 from the pBSC 106 through the server 116 and provides a user with a location and  
6 state of the relevant mobile station 110 according to the location information. At this time, the  
7 client 118 may provide the user with the location and the state of the mobile station 110 as a  
8 simple text, but it is preferred that the location of the mobile station 110 is subjected to Graphical  
9 User Interface (GUI) processing in the server 116 or the client 118, and the client 118 displays the  
10 location of the mobile station 110 on a screen in which a topographical map of a service zone of  
11 the private wireless network 100 is represented. In this case, the location of the mobile station 110  
12 is indicated as the unit of a repeater according to the location information of the respective mobile  
13 stations 110. In addition, the topographical map of the service zone of the private wireless  
14 network 100 is prepared as an electronic map and is stored in the server 116 and the client 118 in  
15 advance. Moreover, the client 118 may provide a user with locations and states of all subscribers'  
16 mobile stations of the private network 100 at a time or provide only the location and state of a  
17 specific mobile station appointed by a user.

18 **[0032]** The mode by which the client 118 receives the location information from the server 116  
19 can be divided into three cases, that is, a first case where location registration of a mobile station  
20 110 is executed, a second case where a message inquiring about a subscriber's state is periodically  
21 transmitted to the server 116 and a third case where a message inquiring about an appointed

subscriber's state is periodically transmitted to the server 116. The first case is a receiving mode in which updated location information is received into the VLR (120) of the pBSC (106) whenever location registration of a mobile station is executed. The second case is a receiving mode in which a message inquiring about a subscriber's state, agreed upon between the client 118 and the server 116, is periodically transmitted to the server 116 and location information is then received as a response to this. Finally, the third case is a receiving mode in which if a user appoints at least one specific mobile station and requests an inquiry about the specific mobile station subscriber's state, a message inquiring about an appointed subscriber's state, agreed upon between the client 118 and the server 116, is transmitted to the server 116 and location information is then received as a response to this. This case corresponds to a case where the user confirms locations and states of a plurality of mobile stations displayed on a screen of the client 118 and then requests the server to find out the current location and state of a specific mobile station.

**[0033]** Hereinafter, a description will be given for subscriber location tracking in accordance with the present invention in conjunction with Fig. 2 showing the respective processing steps 200 to 212 of the client 118, Fig. 3 showing the respective processing steps 300 to 312 of the server 116 and Fig. 4 showing the respective processing steps 400 to 418 of the pBSC in accordance with a preferred embodiment of the present invention.

**[0034]** The client 118 checks in steps 200 to 204 whether location information has been received from the server 116 or not (step 200), whether or not it is time to periodically inquire about a subscriber's state (step 202), and whether an inquiry about an appointed subscriber's state has been requested from a user or not (step 204). At this time, step 210 is performed if the

1 location information has been received from the server 116 (step 200), step 206 is performed if  
2 it is time to periodically inquire about a subscriber's state (step 202), and step 212 is performed  
3 if an inquiry about an appointed subscriber's state has been requested from a user (step 204). The  
4 server 116 checks in steps 300 to 304 whether location information has been received from the  
5 pBSC 106 or not (step 300), whether a message inquiring about a subscriber's state has been  
6 received from the client 118 or not (step 302), and whether a message inquiring about an  
7 appointed subscriber's state has been received from the client 118 or not (step 304). At this time,  
8 step 310 is performed if location information has been received from the pBSC 106 (step 300),  
9 step 306 is performed if a message inquiring about a subscriber's state has been received from the  
10 client 118 (step 302), and step 312 is performed if a message inquiring about an appointed  
11 subscriber's state has been received from the client 118 (step 304). Also, the pBSC 106 checks  
12 in steps 400 to 406 whether new location registration of a mobile station 110 has been executed  
13 or not (step 400), whether a mobile station keeping up an idle state during a certain period exists  
14 or not (step 402), whether confirmation for a location and state of an appointed mobile station has  
15 been requested from the server 116 or not (step 404), and whether an inquiry about location  
16 information has been requested from the server 116 or not (step 406). At this time, step 414 is  
17 performed if new location registration of a mobile station has been executed (step 400), step 408  
18 is performed if a mobile station keeping up an idle state during a certain period exists (step 402)  
19 or if confirmation for a location and state of an appointed mobile station has been requested from  
20 the server 116 (step 404), and step 418 is performed if an inquiry about location information has  
21 been requested from the server 116 (step 406).



1     **[0035]**     First, looking into the case when new location registration of a mobile station 110 is  
2     executed, the pBSC 106 goes from step 400 to step 414 to update location information including  
3     the pBTS number, the sector number and the repeater number according to the location  
4     registration of the mobile station in the VLR 126, transmits the updated location information to  
5     the server in step 416, and then passes to steps 400 to 406 as stated above. Once that happens, the  
6     server 116 goes from step 300 to step 310 to transmit the location information received from the  
7     pBSC 106 to the client 118, and then passes to steps 300 to 304 as mentioned above. If done so,  
8     the client 118 goes from step 200 to step 210 to display a location and state of the mobile station  
9     according to the location information received from the server on a screen in which a  
10    topographical map of a service zone of the private wireless network 100 is represented, and then  
11    passes to steps 200 to 204 as stated above.

12    **[0036]**     Secondly, looking into the case when a mobile station keeping an idle state during a  
13    certain period exists, the pBSC 106 goes from step 402 to step 408 to perform the above-  
14    mentioned dummy paging for the relevant mobile station. At this time, time required for the  
15    dummy paging must be minimized because other incoming calls are generally treated as busy  
16    while the paging progresses. For the purpose of this, as soon as confirmation for a location of the  
17    relevant mobile station by the dummy paging is completed in step 410, the dummy paging is  
18    cancelled by means of a connection rejection message in step 412. Thereafter, the pBSC 106 goes  
19    to step 414 to update the location information according to the confirmation for the location of the  
20    mobile station keeping up the idle state during a certain period in the VLR 120, and transmits the  
21    updated location information to the server 116 in step 416. Once that happens, the server 116

1 transmits the location information received from the pBSC 106 to the client 118 in step 310, and  
2 the client 118 displays the location and state of the mobile station 110 on the screen, in which the  
3 topographical map of the service zone of the private wireless network 100 is represented, in step  
4 210.

5 **[0037]** Thirdly, looking into the case when the point of time to inquire about a subscriber's  
6 state, the client 118 goes from step 202 to step 206 to transmit a message inquiring about a  
7 subscriber's state to the server 116. Once that happens, the server 116 goes from step 302 to step  
8 306 to requests the pBSC 106 to inquire out location information stored in the VLR 120, and then  
9 passes to step 308. In response to the server's request, the pBSC 106 goes to step 406 to step 418  
10 to transmit the location information of the VLR 120 to the server 116. Once that happens, the  
11 server 116 receives the location information from the pBSC 106 in step 308, transmits the  
12 received location information to the client 118 in step 310, and then the client 118 displays a  
13 location and state of the mobile station 110 on the screen, in which the topographical map of the  
14 service zone of the private wireless network 100 is represented, in step 210.

15 **[0038]** Fourthly, looking into the case when an inquiry about an appointed mobile station  
16 subscriber's state is requested from a user, the client 118 goes from step 204 to step 212 to  
17 transmit a message inquiring about the appointed mobile station subscriber's state to the server  
18 116, and then passes to step 208. Once that happens, the server 116 goes from step 304 to step  
19 312 to request the pBSC 106 to inquire out a location and state of the appointed mobile station,  
20 and then passes to step 308. In response to the server's request, the pBSC 106 goes to step 404  
21 to step 408 to perform dummy paging for the mobile station appointed by the user, cancels the

1 dummy paging if confirmation for the location of the mobile station is completed in step 410,  
2 passes to step 414 to update location information according to the confirmation for the location  
3 of the appointed mobile station in the VLR 120, and then transmits the updated location  
4 information to the server 116 in step 416. Once that happens, the server 116 transmits the location  
5 information received from the pBSC 106 to the client 118 in step 310, and then the client 118  
6 displays the location and the state of the mobile station 110 appointed by the user on the screen,  
7 in which the topographical map of the service zone of the private wireless network 100 is  
8 represented, in step 210.

9 **[0039]** Consequently, the subscriber location tracking in accordance with the present invention  
10 has an advantage in that not only a subscriber's location can be precisely tracked up to the unit of  
11 a repeater R in the private wireless network 100 without using the GPS or executing location  
12 registration of a mobile station and receiving latitude and longitude information of a base station,  
13 but also this precise subscriber location tracking can be realized in a simple fashion.

14 **[0040]** While the invention has been shown and described with reference to certain preferred  
15 embodiments thereof, it will be understood by those skilled in the art that various changes in form  
16 and details may be made therein without departing from the spirit and scope of the invention. In  
17 particular, the mode by which the client 118 receives the location information from the server 116  
18 has been exemplified in connection with all the cases when location registration of a mobile  
19 station 110 is executed, a message inquiring about a subscriber's state is periodically transmitted  
20 to the server 116 and a message inquiring about an appointed subscriber's state is transmitted to  
21 the server 116, but any case can be selectively applied to the receiving mode as occasion demands.

1 In addition, one example in which the server 116 inquires about location information of the VLR  
2 120 provided in the pBSC 106 and transmits it to the client 118 has been given, but a VLR which  
3 maintains location information in the same manner as the VLR 120 of the pBSC 106 can be also  
4 realized in the server 116. If done so, when the server receives a message inquiring about a  
5 subscriber's state from the client 118, the server only have to inquire about location information  
6 of its own VLR and to transmit the location information to the client 118 without inquiring of the  
7 VLR 120 of the pBSC 106, as a result of which the inquiry can be quickly processed and a load  
8 of the pBSC 106 can be relieved. In this case, if the server 116 updates its own VLR whenever  
9 it receives location information from the pBSC 106, the same location information as that of the  
10 VLR 120 of the pBSC 106 can be maintained. Accordingly, the scope of the invention should not  
11 be limited to the embodiments, but should be defined by the appended claims and equivalents  
12 thereof.